# Ken INOUE*: **Beetle pollination of *Platanthera chorisiana* (Orchidaceae)**

# 井上 健*: タカネトンボ（ラン科）の甲虫による送粉

Since Charles Darwin's famous work, 'fertilization of orchids by insects' (Darwin, 1877), the diversity of the orchid flower types has been discussed in relation to the adaptation to the pollinators (van der Pijl & Dodson, 1966).

In *Platanthera,* moths have been reported as the principal pollinators (Darwin, 1877; Gray, 1879; Smith & Snow, 1976; Nilsson, 1979; Inoue, unpublished data), though mosquitoes (Stoutamire, 1968, 1971; Thien, 1969) and butterflies (Smith & Snow, 1976) were rarely found also as pollinators. This short note is to explain, for the first time, one of beetle species as to be a pollinator of the genus.

*Platanthera chorisiana* (Cham.) Reichb. Reichb. f. occurs from North America throughout the Aleutians and the Kurils to Japan (Luer, 1975). This species shows unique morphological features among the Japanese *Platanthera;*

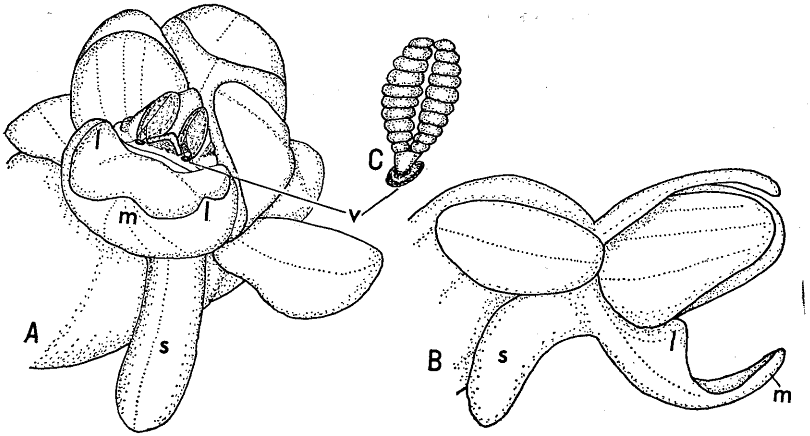

Fig. 1. The floral morphology of *Platanthera chorisiana*. A: Flower, front view. ×23. B: Flower, lateral view ×23. C: Pollinarium. ×78. abbreviations. v: viscidium, m: middle lobe of lip, l: lateral lobe of lip, s: spur.

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that is 1) the smallest flower in the Japanese species (ca. 3 mm in across) (Fig. 1), 2) the incurved lip with lateral lobes at its base (Fig. 1, 1), 3) the short blunt spur of ca. 1.8×0.6 mm (Fig. 1, s).

**Study sites and methods** Field observation were carried out on July 14-17, 1980, at three sites of Isl. Rebun, Hokkaido, the northernmost region of Japan (Table 1). *P. chorisiana* is a rare plant in Japan occurring sporadically in the alpine or subalpine zone, but in Isl. Rebun it grows considerably common at the lowlands. The observation were mainly made at Nairo, where the flowers of *P. chorisiana* were almost in full bloom, but the upper flowers of the inflorescences still remained unfertilized. In the night observation, an electric torch was used on 15, July and the light trapping (three 20 w inflorescent lights including one black-light with a handy generator) on 16, July. For identification of insects I am grateful to Dr. M. Owada of National Science Museum, Tokyo.

Tab. 1. Study sites and flowering stages for pollination of *Platanthera chorisiana* in Isl. Rebun.

| Study site | Outline of vegetation | Number of inflorescences (in ca. 5×200 m) | Stage of flowering |
|---|---|---|---|
| Nairo | Grassland of *Sasa* | ca. 100 | In full bloom |
| Uedomari | Grassland of *Sasa* | ca. 60 | In full bloom |
| Rebun-rindo to Uennai | Margins of *Abies* forest | ca. 40 | In early bloom |

**Observations** After sunset no insects were observed to visit *P. chorisiana* and no pollinaria (Fig. 1, C) were found on the trapped insects around the flowers. In the daytime (10:00 AM-3:00 PM), several species of insects visited the flowers of *P. chorisiana*. On observation of the trapped insect bodies, pollinaria of *P. chorisiana* were only found on *Oedemeronia lucidicollis* (Oedemeridae), the small black beetle of ca. 8 mm in length and 1.8 mm in width (Fig. 2, Fig. 3, A). From the fourteen captured beetles of the same species, only eight carried the pollinaria on their body. Through the process of killing and preservation, however, only four beetles out of eight left intact with the pollinaria on their body. Of the four insects, two had pollinaria attached to their heads bsetween the antennae (Fig. 3, B) and the remaining two to the mouth parts. The flies were observed to visit and rest on the inflorescences,

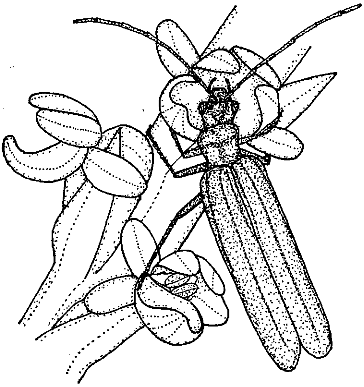

Fig. 2. *Oedemeronia lucidicollis* (female) visiting *Platanthera chorisiana*. ×10.

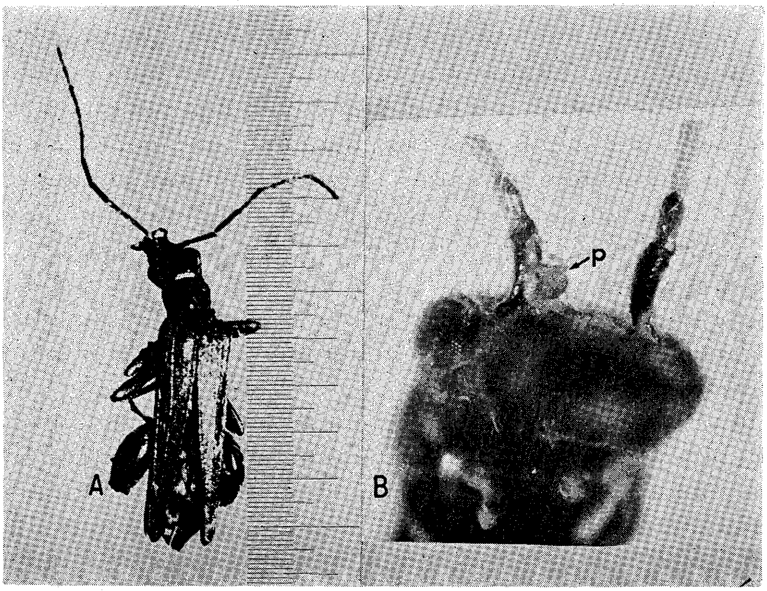

Fig. 3. *Oedemeronia lucidicollis*. A: Whole insect (male). ×9. B: Front view of head (female), showing attachment of pollinarium (p) of *P. chorisiana* between the antennae. ×48.

but they did neither search for nectar nor carried pollinaria. Flower spiders (*Xysticus* sp.) were also found on the inflorescences, sometimes killing the beetle with attached pollinarium.

In the process of pollination of *P. chorisiana*, a beetle flew onto the flower of the lower part of inflorescence and pushed its head between the middle (Fig. 1, m) and lateral lobes (Fig. 1, l) of the lip in search of food for a few seconds (Fig. 2). The flower may be fertilized by the beetle with attached pollinaria when it feeds on food. After finishing a flower, the beetle clambered up the inflorescence in search of a new flower. The lower flowers on inflorescences opened earlier and no pollinaria were found in them. When the beetle visited the upper flowers which bloomed later, a single fresh white pollinarium attached to the body. As it reached at the top of opened flowers in the inflorescence, it flew onto different inflorescence of the same species or took rest on leaves of other plants (*Sasa kurilensis* etc.) growing nearby. In a few cases the beetle may crawl down the inflorescence to repeat the same motion from the bottom.

The space between the middle and the lateral lobes of the lip as well as the form of the spur is well adapted to this beetle-pollinator. The middle lobe of the lip is projected forward and incurved so that the beetle are obstructed to enter from rightly anterior side of the flower. The lateral lobes of the lip are also incurved and leaving enough space between the middle and lateral lobes for the insects to insert their heads. The orifice of the spur is located at the back of this space, the viscidium being situated on the upper side of it (Fig. 1, v). When insect touches the viscidium as feeding on food, it may adhere to the insect body. The spur of *P. chorisiana* is 1.8±0.2 mm long (n=79). The spurs of young unfertilized flowers filled with nectar up to one third of its length. In the older flowers, nectar increases up to two thirds and in the extreme cases it overflows the spur.

**Discussion** In Orchideae beetle pollination has been reported on *Coeloglossum viride* and *Herminium monorchis*, according to the list of pollinators in the family Orchidaceae compiled by van der Pijl & Dodson (1966). In Neottieae beetle pollination was also illlustrated for *Listera ovata* by Proctor & Yeo (1973). In the above three species, beetles were described as co-pollinator with other insects such as wasps, flies and mosquitoes.

In my field observation on *P. chorisiana*, such insects as mentioned above have not been observed. In the author's mind, the beetle (*Oedemeronia lucidicollis*) is a main pollinator of the orchid in Isl. Rebun.

It is generally said that the beetle, *Oedemeronia lucidicollis*, visits flowers for pollen. In my observation, the beetle seemed to be attracted by both nectar and pollen. The place of attachment on the insect body sugest this line. This species is well adapted in the floral structure to be pollinated by the small beetle. In the young unfertilized flower, the lip and three tepals (a single dorsal sepal and two lateral petals) are coming too near each other giving no space for the beetle to feed on food, nectar being still scanty. When the flower matures, this space mentioned above bebomes wider enabling the beetle to enter inside. Nectar tends to overflow in this type of short-spurred flowers which make possible more easily for beetles to feed on. The space between middle and lateral lobes of lip restricts the direction of beetle to enter inside. This causes the pollinarium to adhere to the insect body.

Several floral structure of this plant such as length of the spur, shape and position of the lip and small size of the flower are well fit for pollination of small beetle. The amount of nectar and maturation of flower also connect with beetle pollination. However, such flower features may hot exclude other type of insects as the pollinator. Though there are a few reports on beetles as pollinators in the orchid family, small beetles may also play a major role on pollination in other spurless or short-spurred small flowered orchids.

## Literature cited

Darwin, C. 1877. The fertilization of orchids by insects. 2nd ed. John Murray, London. Gray, A. 1879. The botanical text-book. Macmillan, London. Luer, C.A. 1975. The native orchids of the United States and Canada, excluding Florida. New York Bot. Gard., New York. Nilsson, L.A. 1978. Bot. Notiser **131**: 35-51. Piji, L. van der & C.H. Dodson. 1966. Orchid flowers: their pollination and evolution. Coral Gables, Florida. Proctor, M. & P. Yeo. 1973. The pollination of flowers. Collins, London. Smith, G.R. & G.E. Snow. 1976. Bot. Gaz. **137**: 133-140. Stoutamire, W.P. 1968. Michigan Botanist **7**: 203-212. ——. 1971. Pollination in temperate American orchids. In M.J.G. Corringan (ed.): Proc. 6th World Orch. Conference p. 233-243. Halstead Press, Sydney. Thien, L.B. 1969. Amer. J. Bot. **56**: 232-237.

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1980年7月にタカネトンボの送粉昆虫の観察を北海道礼文島で行った。その結果，甲虫の1種が送粉を行っている事が判明した。タカネトンボを含むツレサギソウ属では送粉昆虫として主に蛾が報告されており，甲虫の報告は初めてである。また，ラン科全体でも甲虫による送粉の例は少ないのでここに報告する。

甲虫はモモブトカミキリモドキと同定された。花粉塊の付着位置は口器と触角周辺の頭部であることから，この甲虫は花粉と蜜の両方を求めて訪花すると推定した。タカネトンボの唇弁の形，短い距，距にたまる蜜量，花の開き具合などはこの甲虫によく適合している。更に研究が進めば，距の未発達もしくは短いランにおいて，甲虫が送粉昆虫である例が更に増えることが期待される。

### **○アズマザサ属数種類の学名訂正**（鈴木貞雄） Sadao SUZUKI: Corrections of the names for several taxa of the genus *Sasaella*

本誌 **51**: 269〜274 頁のヒシュウザサの変種およびアタミシノの種とその変種の学名に誤りがあることを，植物分類地理 **30**: 第4〜6号 (1979) のなかの村田源氏の論文「植物分類雑記 13」によって指摘され気がついたので，私の不注意を心からお詫びして再び下記の如く訂正します。村田源氏に厚く感謝いたします。

1) **Sasaella leucorhoda** (Koidz.) Koidz. in Acta Phytotax. Geobot. **10**: 297 (1941).—*Pleioblastus leucorhodus* Koidz. l.c. **3**: 15 (May 1934).—*Arundinaria leucorhoda* (Koidz.) Koidz., l.c. 151 (1934); Murata in Acta Phytotax. Geobot. **30**: 142 (1979).—*Sasaella atamiana* (Nakai) S. Suzuki f. *leucorhoda* (Koidz.) S. Suzuki, Index Jap. Bamb. 363 (1978).

var. **leucorhoda** f. **leucorhoda**

Nom. Jap. Tango-shino, Tango-shinochiku.

f. **atamiana** (Nakai) S. Suzuki, comb. nov.

*Arundinaria atamiana* Nakai in Journ. Jap. Bot. **10**: 573 (Sep. 1934).—*Sasaella atamiana* (Nakai) S. Suzuki in Journ. Jap. Bot. **51**: 272 (1976) et Index Jap. Bamb. pl. 96, 260, 363 (1978).—*S. atamiana* Makino ex Nakai in Rika Kyôiku **15**: 75 (1932), nom. nud.—*Arundinaria leucorhoda* (Koidz.) Koidz. f. *atamiana* (Nakai) Murata in Acta Phytotax. Geobot. **30**: 142 (1979).

Nom. Jap. Atami-shino, Atami-nezasa.

var. **kanayamensis** (Nakai) S. Suzuki, comb. nov.

*Arundinaria kanayamensis* Nakai in Journ. Jap. Bot. **10**: 743 (1934).—*Sasaella kanayamensis* (Nakai) Nakai ex Koidz. in Acta Phytotax. Geobot. **10**: 297 (1941).—*S. atamiana* var. *kanayamensis* (Nakai) S. Suzuki in Journ. Jap. Bot. **51**: 273 (1976) et Index Jap. Bamb. pl. 97, 262, 363 (1978).—*Arundinaria leucorhoda* (Koidz.) Koidz. var. *kanayamensis* (Nakai) Murata in Acta Phytotax. Geobot. **30**: 142 (1979).

Nom. Jap. Ke-sueko-zasa.

2) **Sasaella hidaensis** (Makino) Makino in Journ. Jap. Bot. **6**: 15 (1929);